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Title: Process & Equipment for Producing Pectin by Pre-acidolysis & High acidity Continuous Extraction

Abstract

This invention provides a process and equipment for extracting pectin from peel, fruit, characterized in that the pre-acidolysis and high acidity continuous extraction are used, i.e. after pretreating, the peel is mixed with acid solution and heated in pre-acidolyzer for a certain time, then fed into extracting unit, extracted stage by stage to make pectin in peel dissolve in acid solution, and then it is filtered, alcoholized and alcohol-washed. The inventive process and equipment is simpler than the existing intermittent process, the liquid extract has no need of concentrating and decolorizing. It saves alcohol and has high yield of pectin:

Claims

1. A process for extracting pectin from plant material such as peel, fruit, fruit pomace etc, comprising the steps of pretreating, acid solution extracting, alcoholizing, filtering, precipitating and alcohol-washing, characterized

in that the plant material after pretreating in mixed with acid solution in a pre-acidolyzer, then fed into an extractor, the material is come into continuously counter-current contact with acid extracting solution, the pectin's liquid extract obtained has no need of concentrating and decolouring, alcoholyzes directly, passes through the steps of precipitating, filtering, alcohol-washing and drying to give the product.

2. The process for extracting pectin according to claim 1, characterized in that the acid solution for pre-acidolyzing and extracting in a 1-5% hydrochloric acid or phosphoric acid, or a 5-10% acetic acid, the ratio of pre-acidolyzing solution to the plant material pretreated is 0.1-1, the temperature of pre-acidolysis is 50-90°C, the residence time of the material in pre-acidolyzer is 0.5-2 hours, the ratio of acid extracting solution to the material pretreated is 0.5-3, the residence time of the material after pre-acidolyzing in extractor is 0.5-3 hours, the temperature of acid solution for spraying is 60-90°C, the spirit concentration for alcoholyzing is 20-35%.

3. The equipment for extracting pectin according to claim 1, comprising a pre-acidolyzer (6) and an extractor (8) having the moving screen driven by a motor, three containers (9), (10) and (11) beneath the moving screen, steam heated indirectly, and three sprayers (12), (13) and (14) above the moving screen, piping at bottom of container (9) leading

to the subsequent steps of filtering and alcoholizing, piping at bottom of container (10) passing through concentrated solution pump (18) leading to sprayer (12), further piping at bottom of container (11) passing through diluted solution pump (17) leading to sprayer (13) above the moving screen, acid preheater (15) leading to sprayer (14); a hopper (16) at the right end opening of the moving screen.

Specification

This invention relates to a process for extracting pectin from peel, fruit and fruit pomace.

Pectin is a water-soluble plant gum present in plant such as fruit vegetable. Its main chemical constituents are polygalacturonic acid and minor neutral sugars: L-arabinose and D-galactose etc. It is a natural food additive which finds wide use for food, biological and medical industries, and serves as emulsifying, thickening, stabilizing etc. At present, the intermittent low acidity (PH 1-3) extraction process is generally used for producing pectin as disclosed in CN 89104017 and "Processing and multipurpose use of citrus pomace" Sichuan Science & Technology press 1987 etc. The disadvantages of these process are: 1 low acidity of extracting solution, high ratio of liquid /solid (extracting solution: dry peel=20:1) being required during extraction: the pectin content in extracting solution

obtained being about 0.3-0.5, during alcoholizing, high spirit content (>55%) of solution being required; 2. Concentration of extracting solution being required and owing to the easy decomposition of pectin at high temperature, the energy consuming vacuum concentration being required; 3. owing to the deeper colour of solution after concentration, the active carbon decolorizing being required; 4. long flow path of the whole process, making the pectin easy to decompose and poor in quality; 5. Low yield of pectin, the recovery generally being lower than 80%.

The object of this invention is to provide the process and equipment for extracting pectin which overcoming the disadvantages of the prior art, simple process, saving alcohol, continuous producible, high yield of pectin.

This invention is achieved like this: firstly, the plant material such as peel, fruit, fruit pomace etc is trashed, smashed, enzyme-deactivated, riused, and then preheated, mixed with acid solution and converted to water-soluble pectin in pre-acidolyzer. The material simultaneously moves forward, flows off from the other end of pre-acidolyzer, and feeds onto the moving screen of extractor, pectin dissolves in high acidity extracting solution which is sprayed down continuously from the above of screen. The pectin-containing material is counter-currently extracted by the high-acidity extracting solution. The pectin content of said solution flew off from the extractor is up to 1.5-2.5.

The pectin's liquid extract obtained has no need of concentrating and decolorizing, and a precipitate can promptly be obtained by alcoholysis with a 25-35% ethanol solution. Said precipitate can be further alcohol-washed with 95% spirit, and dried, pulverized to obtain high-purity solid pectin.

The inventive process is given in Fig. 1.

In Fig. 1, the steps for producing high quality pectin are: firstly, trashing the natural plant which contains more pectin such as citrus peel, apple peel, haw, beet pulp; smashing into $< 2\text{cm}^2$ chips; rinsing in clean water for 10 min; then washing with about 70°C hot water for 5-10 min to deactivate the enzyme; pre-acidolyzing in the screw pre-acidolyzer; extracting pectin by spraying the acid solution in extractor; discharging fruit pomace for multipurpose use; separating out the pectin precipitate by adding a 20-35% ethanol solution; filtering: the liquid phase fed to ethanol recovery step, the solid phase further alcohol-washed with 95% ethanol; filtering again; drying; pulverizing to give high quality solid pectin product.

The chemical procedure of this invention is to make the insoluble pectin in the plant material by the action of acid convert to soluble pectin. The acid used can be any of the following: hydro-chloric acid, oxalic acid, phosphoric acid, acetic acid, malic acid etc, preferable hydrochloric

acid, phosphoric acid and acetic acid.

The main equipment for achieving this invention is pre-acidolyzer and extractor. The pre-acidolyzer is a horizontal container with steam jacket, one end having a feed hopper, the middle having a screw shaft which serves to make the material move forward continuously and mix uniformly; the jacket serves as steam heating to ensure the material temperature; the continuous extractor comprises moving acid-resistant screen, three square containers in parallel or in series, equipped with steam heating (e. G. Coil pipe), and three sets of spray thrower. The screen serves to make the material move forward and filter simultaneously during extraction; the three square contains serve to contain extracting solution and ensure the solution temperature; the spray equipment serves to make the extracting solution uniformly contact with the material.

The accessory equipment includes acid meter, pretreated material meter, extracting solution pre-heater and circulating pump. The acid meter and pretreated material meter serve to mix the acid solution in proportion with the pretreated material the preheater serves to heat the acid solution to the temperature of pre-acidolysis and of extraction, the circulating pump serves to conveyer the acid extracting solution.

The difference between the invention and the existing production equipment lies in the steps of pre-acidolysis and acid extraction. They play an important role for achieving the continuous acidolysis and extraction. The equipment of other portions such as alcoholizing, filtering, ethanol recovering, alcohol-washing, pulverizing, drying is roughly the same as the prior art, and can be designed according to the actual situation.

The process conditions selected for achieving the inventive process are: pre-acidolyzing solution 1-5% hydrochloric acid, or phosphoric acid, or 5-10% acetic acid; the ratio of pre-acidolyzing acid solution to pretreated material 0.1-1; the temperature of pre-acidolysis 50-90 °C; the residence time of the material in pre-acidolyzer 0.5-2 hours; acid extracting solution 1-5% hydro-chloric acid, phosphoric acid, or 5-10% acetic acid solution; the ratio of extracting solution to pretreated material 0.5-3; the residence time on moving screen of the material after pre-acidolyzing 0.5-3 hours; the temperature of acid solution for spraying 60-90°C; the spirit concentration for alcoholizing 20-35%.

Compared with the existing production process the inventive production capacity increases by two times and higher, the consumption of spirit reduces by over 30%, the consumption of energy reduces by 25-30%, the yield of pectin increases by 10% and higher, the quality of pectin is up

to the GBN 246-855 standard.

By referring to Fig. 2, the inventive process flow and equipment's structure are described as follows:

After trashing, smashing, enzyme deactivating, rinsing, the material passes through meter 1; the pre-acidolyzing solution passes through gravitation tank 2 and through preheater 3. The mixture of the material with acid solution in hopper 4 is fed into pre-acidolyzer 6 which is an unit having steam jacket outside and screw 7 material conveyer inside, screw 7 is driven by motor 5. The pre-acidolyzed material is fed into an extracting unit which comprises a moving screen driven by a motor on extractor 8, three containers 9, 10 and 11 beneath the moving screen, steam heated indirectly and three sprayers 12, 13 and 14 above the moving screen, piping at bottom of container 9 leading to the subsequent steps of filtering and alcoholizing, piping at bottom of container 10 passing through concentrated solution pump (18) leading to sprayer 12, further piping at bottom of container 11 passing through diluted solution pump 17 leading to sprayer 13 above the moving screen, acid preheated 15 leading to sprayer 14, a hopper 16 at the right end opening of the moving screen. The operating principle of extracting unit is, the peel coming from pre-acidolyzer 6 is fed into the moving screen of extractor 8, the concentrated solution pumped from container 10 after spraying the extracting solution

obtained is pumped out from container 9 beneath, the last two sprayers are used to further extract the remaining pectin in the peel with acid extracting solution recycles through containers 10, 11 and pumps 17, 18. The final pomace is discharged from hopper 16, thus the object of Leigh-acidity continuous extracting pectin is achieved.

The advantages of pectin extraction according to the above-mentioned process and equipment are: simple process, not need of concentrating and decolouring the extracting solution, low spirit content during alcoholysis, pectin being not liable to decompose, the yield can increase by 10% and higher than the existing intermittent process.

The examples of this invention:

Example 1

Diameter \times length of pre-acidolyzer is $0.3\text{m} \times 2\text{m}$; the material is pretreated citrus peel; pre-acidolyzing solution is 3-5% hydrochloric acid; weight ratio of pre-acidolyzing solution to pretreated citrus peel is 0.6:1-0.8:1; temperature is $65-68^{\circ}\text{C}$; residence time in pre-acidolyzer is 1-1.2 hours; extracting solution is 3-4% hydro-choleric acid solution; weight ratio of extracting solution to pretreated citrus peel is 2:1-3:1; spraying temperature is $70-80^{\circ}\text{C}$; residence time on moving screen of extractor is 1-1.5 hours; pectin content of extracting

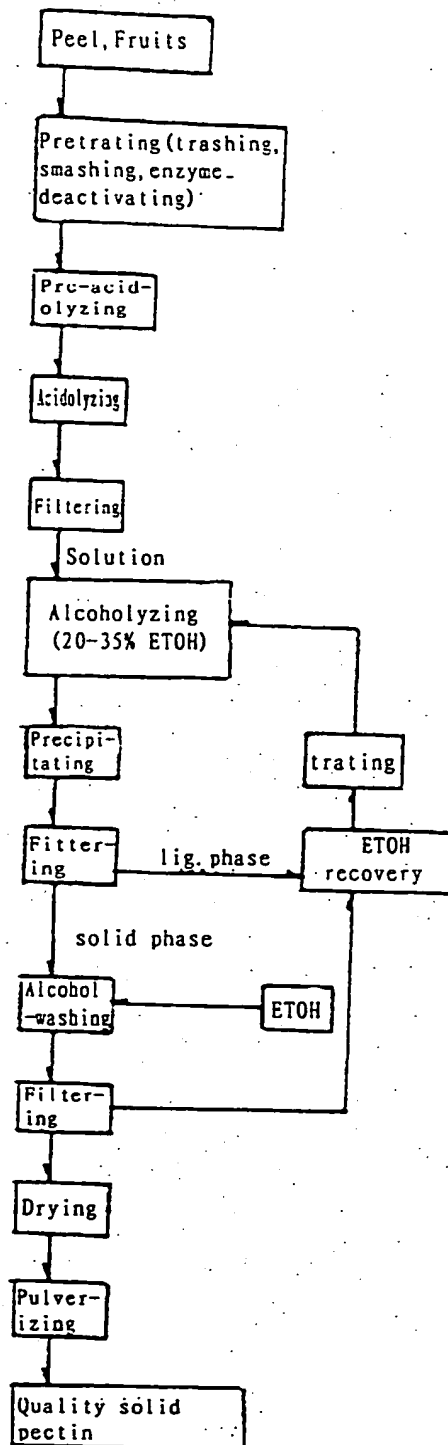
solution after the completion of extraction is 1-2%; the liquid extract has no need of concentrating and decolorizing, alcoholyzes by adding spirit directly; the concentration of spirit for alcoholysis is 22-26%; yield of pectin is 93-96%.

Example 2

Various operating conditions are the same as example 1, except the pre-acidolyzing solution and extracting solution being 1-5% phosphoric acid.

Example 3

Diameter \times length of pre-acidolyzer is 0.2m \times 2m; the material is pretreated apple pomace; pre-acidolyzing solution is 2-4% hydrochloric acid; weight ratio of pre-acidolyzing solution to pretreated apple pomace is 0.4:1-0.6:1; temperature is 65-68°C; residence time in pre-acidolyzer is 1-1.5 hours; extracting solution is 3-4% hydrochloric acid solution; weight ratio of extracting solution to pretreated apple pomace is 1.5:1-2:1; spraying temperature is 68-72°C; residence time on moving screen of extractor is 1.2-1.8 hours; pectin content of extracting solution after the completion of extraction is 1.4-2.3%; the liquid extract has no need of concentrating and decolorizing, alcoholyzes by adding spirit directly; the concentration of spirit for alcoholysis is 25-30%; yield of pectin is 92-95%.



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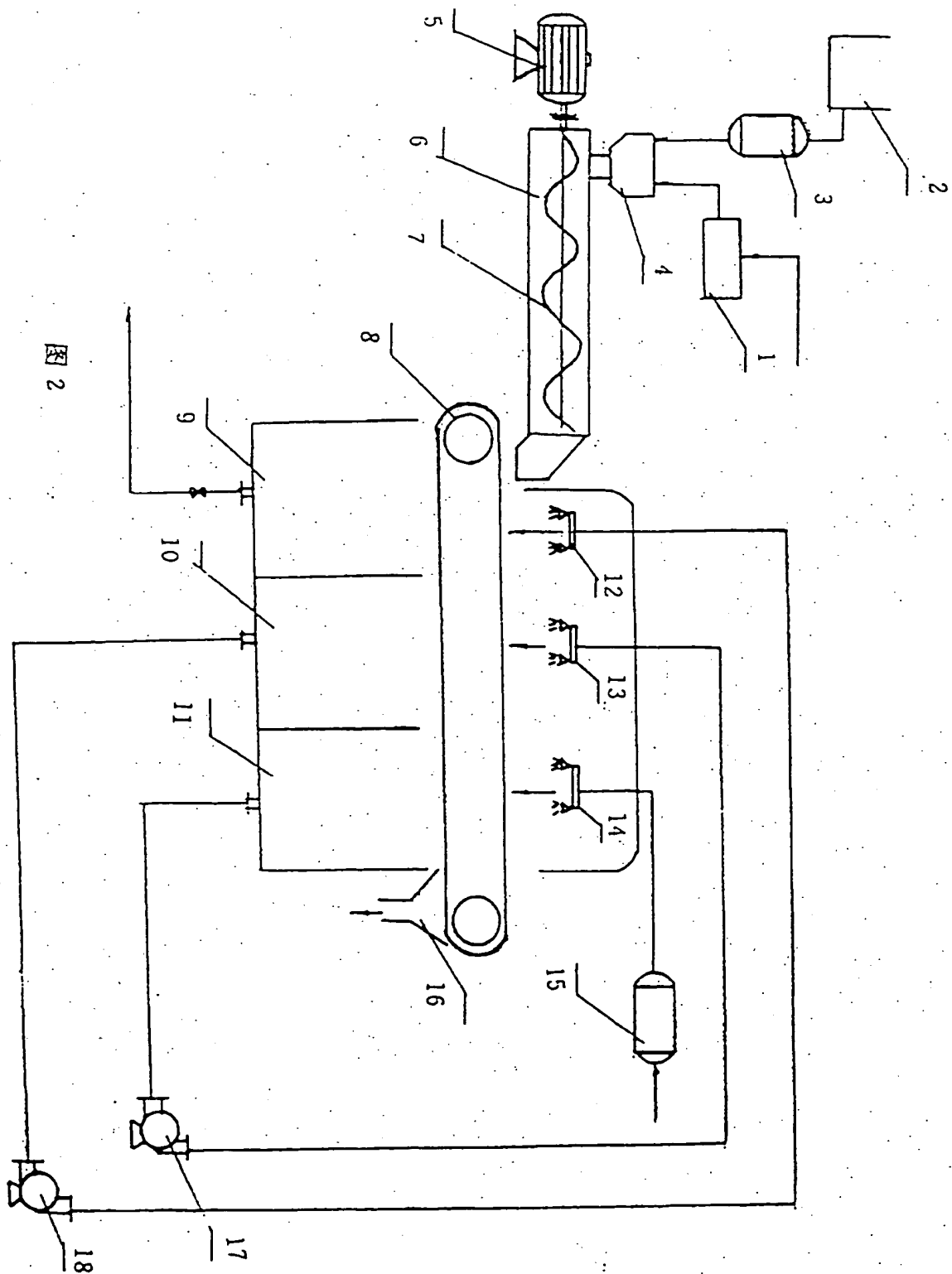


图 2

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